TRABAJOS ESPECIALES DE MAESTRIAS, DOCTORALES Y DE ASCENSO

Nº	Carpt.		Pág.
1	254	CARRILLO PERERA Eduardo. L´enregistremet sédimentaire de la sismicité récente le long de la frontiére sud-occidentale de la plaque Caraïbe (faille de Boconó): modalités et chronologie. contribution á l´estimation de l´aléa sismique régional.	193
2	255	CHRISTENSEN Richard Martin. Geology of the Paria-Araya peninsula, northeaster Venezuela.	193
3	256	DASH Lawrence E. U-Pb Geochronology of the sierra de Perijá, Venezuela.	194
4	257	FOURNIER Herbert. Geochronology and thermochronology of shear zones from the strangways and the harts range metamorphic complexes, central Australia.	195
5	258	MCMAHON Cathleen Elizabeth. Evaluation of the effects of oblique collision between the Caribbean and South American plates using geochemistry form igneous and metamorphic bodies of northern Venezuela.	195
6	259	NAVARRO FARRÁN Enrique. Petrogenesis of the eclogitic rocks of isla de Margarita, Venezuela.	196
7	260	ONSTOTT Tullis Cullen. Paleomagnetis of the Guayana shield, Venezuela and its implications concerning Proterozoic tectonics of South America and Africa.	197
8	261	PÉREZ F. Luis A. Los sistemas de información geográfica y la teledetección espacial en el análisis de la información geológica de la región Todasana-Cabo Codera-Capaya, cordillera de La Costa.	198
9	262	ROLLINS John Flett. Stratigraphy and structure of the Goajira peninsula, nortwestern Venezuela, and northeaster Colombia.	199
10	263	SKERLEC Grant Michael. Geology of the Acarigua area, Venezuela.	199
11	264	URBANI P. Franco. Phase equilibria and spatial extent of chemical equilibration of migmatite rocks from Colorado, USA and Venezuela.	200
12	265	VIERBUCHEN Richard Carl Jr. The tectonics of northeastern Venezuela and the southeastern of Caribbean sea.	201
14	266	REYES A. Edad y relaciones de campo del grupo el Barbasco, macizo de El Baúl.	202

L´ENREGISTREMET SÉDIMENTAIRE DE LA SISMICITÉ RÉCENTE LE LONG DE LA FRONTIÉRE SUD-OCCIDENTALE DE LA PLAQUE CARAÏBE (FAILLE DE BOCONÓ): MODALITÉS ET CHRONOLOGIE. CONTRIBUTION Á L´ESTIMATION DE L´ALÉA SISMIQUE RÉGIONAL

CARRILLO PERERA Eduardo
Université de Savoir. Département de Sciences Mathématiques, de la Matiére, de la Terre et de la Vie. 2006
(Texto completo 343 p. en DVD anexo, carpeta 254)

La frontiére sud de la Plaque Caraïbe est considérée comme uné limite complexe dont la Faille de Boconó représente une des structures les plus importantes. Avec un mouvement décrochant dextre moyen de 6mm/an, la Faille de Boconó décale le systéme de moraines du Denier Maximum Glaciaire – localement nommé Glaciation Mérida – localicé dans la partie centrale des Andes de Mérida au-dessus des 2800 m d´altitude. Des nombreux lacs sý sont developpés en ont permis tant l´enregistrement de changement climatiques que ceux de l´activité sismotectonique. Deux des ces remplissages lacustres, le lac de Mucubají et la paléolac de Los Zerpa, sonts étudiés avec l´objectif d´établir una chronologie paléosismique á travers de l´identification de l´impact des paléo-séismes sur la dynamique sédimentaire etr la déformation des dépôts.

Dans le lac de Mucubají, l´enregistrremet de la paléosismicité a été marqué par différentes expressions des changements paléobathymétrique du bassin. Les analyses granulométriques de haute résolution, Suceptibilité Magnétique, Pyrolyse Rock-Eval et l´Anisotropie de Susceptibilité Magnétique montret que des modofications brutales et durables dans la dynamique de dépôts sont associées aux effondrements et basculaments ver l´Est du substratum morainique, interprété comme sismo-induits. La diminution de l´apport des paléoséismes et leur trace devient probablement contrôlée par la resuspension et la reconcentration d´élements chimiques et de la matiére organique. La corrélation des carottes avec les sédiments affleurants suggére la présense d´un lac plus étendu qui recouvrait la totalité de la vallée; la subsidence locale et progressive de systéme morainique contrôlerait la diminution de l´extensino du lac. Les principaux évènements climatiques du Quarternaire tardif dans l´Hémiphere Nord sonts identifiés à travers le signal de Suscetibilité Magnétique. Cependant, son expression reste sujette aux variations de la dynamique de dépôt. Au total, sept paléoséismes sont proposés dans la región de Mucubají: 15870(1430-15220).; 14000; 12960 (13140-12660); 10890 (11170-10740); 9120 (9290-9010); 7000 cal; 680cal yrs BP.

Dans le paléolac de Los Zerpa, l´enregistrement de la paleosismicité est défini par des expressions différentes:l´architecture des terresses; la migration de l´exutoire vers l´Est; des slunps; la sédimentation des homogénites et la deformation des dépôts deltaïques. L´effondrement du substratum morainique qui est à l´origine de la subsidence du bassin, est contrôlée par le déplacemet dextre et normal de la Faille de Boconó. Ce déplacement a induit des vidanges successives pedant le fonctionnement du lac, lequel, on estime, a été définitivement désactivñe par une fracture majeure du barrage morainique. Dans le remplissage lacustre qui a été actif aumoins depuis 9700-9480 cal yrs BP, quatre séismes ont pu être datés dans les facies deltaïques: 1240 cal yrs BP 1420 cal yrs BP; 1250 cal yrs BP; et 1720 cal yrs BP. Douze dépôts turbiditiques avec des niveaux argileux homogénes de récurrence estimée de 346 ans sont aussi interprétés comme co-sismiques.

On conclut que l enregistrement de la paléosismicité est variable dans le temps et ne doit pas être analiysé sous un seul paramétre. Dans les dépôts lacustres des barrages morainiques de la zone d´étude l´enregistrement de la paléosismicité est marqué par l´incision des terrasses, les dépôts gravitaires sous aquiatiques, la resuspension et la reconcentration chimique et minéralogique des sédiments.

Une chonologie paléosismique du Pléistocène-Holocène pour la región centrale des Andes de Mérida est proposée. Les déformations cosismiques observées sur les différentes sites permetant d´interpreter cinq paléoséismees régionaux vers 15400-16400; 13500-14500; 9010-9550; 1400-7830; 640-740 cal yrs BP.

GEOLOGY OF THE PARIA-ARAYA PENINSULA, NORTHEASTER VENEZUELA

CHRISTENSEN Richard Martin
The University of Nebraska. Ph.D. 1961
(Texto completo 153 p. en DVD anexo, carpeta 255)

The eastern coastal range of the Paria and Araya Peninsulas consists of highly deformed metamorphic rocks of the Caribbean Series intruded by serpentinites and igneous rocks of intermediate composition. Pliocene and Pleistocene sediments locally overlie the metamorphic rocks. The metamorphics occur only north of the El Pilar fault zone,

which separates them from sedimentary rocks of probable equivalent age to the south. In the area of study, the stratigraphic section of the Caribbean Series consists of the following formations, from oldest to youngest: the "Maraval", the "Las Brisas", the "Antimano", the "Las Mercedes", and the "Tacagua", all apparently in normal depositional contact. That portion of the succession from the base of the "Las Brisas" formation through the "Tacagua" formation appears to be correlative with the Caracas Group as defined within the Caracas region. On the Araya Peninsula, an additional sequence of metamorphic rocks is exposed. These rocks of the "Araya Metamorphic Sequence" are believed to be younger than the "Tacagua" formation. The metamorphic rocks of the Paria-Araya area are of late Jurassic to mid-Cretaceous age, and this cannot exist as the "basement complex" beneath the sedimentary rocks of equivalent age in the Eastern Venezuela Basin.

All of the metamorphic rocks of the Paria-Araya area are of the greenschist facies of regional metamorphism. The older formations within the metamorphic sequence are of the quartz-albite-muscovite-chlorite subfacies. The rocks of the "Araya Metamorphic Sequence" perhaps attain the quartz-albite-epidote-almandine subfacies of regional metamorphism. Serpentinite intrusions occur along a line trending about N80ºE, cutting across regional strike. Some of these serpentinites may have been intruded in the solid state and somewhat above the ambient temperature of the intruded rocks. Dynamic metamorphism took place within a partially closed system, with high water pressure and high partial pressure of carbon dioxide.

Regional strike within the area is approximately N70ºE, and regional dip is toward the northwest. The entire peninsula is an anticlinorium consisting of several en echelon anticlines overturned and thrust southwardly, and plunging both to the northeast and southwest. Drag folds and fold-type lineations are evident throughout the area. Analysis of lineation and jointing indicates compressions from about N20ºE. The El Pilar fault is interpreted as a right-lateral wrench fault. Specific evidence of the direction of movement is lacking, but regional structure indicates deformation by a right-lateral force couple oriented about east-west. By analogy with wrench fault systems of the Greater Antilles, postulated movement along the El Pilar fault zone is estimated to be on the order of at least several tens of kilometers. Thermal spring activity along the El Pilar fault zone may be the result of the continued expulsion of metamorphic waters, or of recent igneous activity.

U-Pb GEOCHRONOLOGY OF THE SIERRA DE PERIJÁ, VENEZUELA

DASH Lawrence E.
Case Western Reserve University. Ph.D. 1982
(Texto completo 185 p. en DVD anexo, carpeta 256)

Zircon U-Pb ages have been obtained from 4 granites, 2 volcanis, and 1 gneiss collected along the Eastern flank of the Sierra de Perijá, Venezuela. In addition, a fifth granite was collected from Toas Islan, located near the northern extreme of Lake Maracaibo. Zincon separates from 3 related granites all show a minor detrital compone tan together define a discordia whose lower intercept, 167 ± 3m.y., is interpreted to represent the age of crystalization, and upper intercept of about 1400 m y., is interpreted to represent an "average" age for the inherited Pb component. Zircons from a hornblende andesite lava interbedded within the La Quinta Formation are uniform euhedral and give nearly concordant results at about 163± 5.m.y. Zircons from a welded tuff breccia, also within the La Quinta Formation, show a minor detrital component, and the results at about 140-160 m.y. on the age of eruption. Together, these data document a major period of mid-Jurassic igneous activity in the Perijás.

Zircons from the Lajas granite comprise a morphologically bimodal suite with one component having detrital characteristics. Hand picked grains yielded a 1050 m y. Pb/Pb age fon the detrital component. Five others fractions form an arcuate pattern of discordance, for which a simple model suggests crystallization ages from about 310 to 385 m.y. Zircons from the Toas Island granite are uniform and euhedral and a best fit line defines an upper intercept of 252 ± 50 m.y., interpreted to represent a estímate for the age of crystallitazation, and lower intercept, 14 ± 60 m y., interpreted to represent seondary discordance associated with relatively recent tectonics along the Oca transform fault. It may be suggested that these posible Permian and Devonian aged granites represent products of orogenic activiti in the Perijás.

Zircons from the granitic gneiss show morphologic heterogeneity and 5 data points plot as scattered cluster. Assuming that secondary discordance occurred, an age interpretation model suggest that metamorphism occurred no earlier than late Devonian but prior to the end of the Paleozoic era. Zircon characteristics and data scatter are used to suggest that the pre-metamophic rocks had a sedimentary component, derived from Precambrian source terrains with deposition taking place between latest Precambrian and late Devonian times. It can be concluded thatat least some of

the units classed as old basement were not metamorphosed in pre-Devonian or Precambrian times as previously thought.

Inheritance of older Pb in the granites, attributed to the observed presence of detrital zircons or to zircons containing older zircón xenocrytic inclusions, is evidence to suggest that the granites originated as anatetic melts, that they assimilated zircon bearing country rocks during emplacement, or both. Lack of an inherited Pb component in the hornblende andesite suggests that its magma, unlike the granite magmas, must have originated and been emplaced under conditions that prevented the magma from incorporating zircons that contained a component of older Pb.

GEOCHRONOLOGY AND THERMOCHRONOLOGY OF SHEAR ZONES FROM THE STRANGWAYS AND THE HARTS RANGE METAMORPHIC COMPLEXES, CENTRAL AUSTRALIA

FOURNIER Herbert
Queen's University. M.sc. 2007
(Texto completo 308 p. en DVD anexo, carpeta 257)

Shear zones play an active role in the exhumation and deformation of geological terranes and can serve as time markers in their geologic evolution. The Strangways Metamorphic Complex (SMC), which includes the Oonagalabi Tongue, forms part of the Arunta Region, central Australia, a large (200,000 km^2) Proterozoic granulite terrane. Palaeozoic high-strain zones at amphibolite-facies grade reworked the granulites throughout the Arunta.

Through a combination of analytical techniques involving crystal chemistry (electron microprobe) and isotopes ($^{40}Ar/^{39}Ar$ and Rb/Sr geochronology and oxygen isotopes) on shear-zone rocks from the SMC, this study aims to determine whether the final exhumation path of the central Arunta (Strangways Range) is significantly different from the eastern Arunta (Harts Range).

Many shear-zone rocks contain muscovite and biotite which are aligned parallel to the stretching lineation, suggesting that these minerals grew during movement along the shear zones. The majority of the samples were metamorphosed to upper-greenschist facies / lower-amphibolite facies, yielding estimated peak metamorphic conditions of 3 kbar and 400ºC. Calculated Ar closure temperatures of muscovite were higher (~400 ºC) than biotite (<335 ºC). $^{40}Ar/^{39}Ar$ and Rb/Sr muscovite have similar ages of ~345 Ma, implying that muscovite grew at or below its Ar closure temperature (~400 ºC). Rb/Sr biotite ages are slightly younger at ~320 Ma, consistent with slow cooling, and are interpreted to represent cooling ages at ~300 ºC. $^{40}Ar/^{39}Ar$ biotite ages are generally older than $^{40}Ar/^{39}Ar$ muscovite ages, likely due to excess argon, although the reason for preferential uptake of excess Ar in the biotite remains unknown.

From this work, the SMC experienced slow cooling, at ~5.0 ºC/Ma, from peak metamorphism (600°C at 380 Ma) to 300 °C at 322 Ma during the Alice Springs Orogeny (300-400 Ma). This is slower than the estimated cooling rate of ~7.2ºC/Ma for the eastern Harts Range, which is interpreted to have been more strongly perturbed thermally by the Larapinta event (440-480 Ma). An exhumation rate of ~0.24 km/Ma from 380 Ma to 345 Ma was calculated for the SMC, representing ~8.4 km of exhumation.

EVALUATION OF THE EFFECTS OF OBLIQUE COLLISION BETWEEN THE CARIBBEAN AND SOUTH AMERICAN PLATES USING GEOCHEMISTRY FORM IGNEOUS AND METAMORPHIC BODIES OF NORTHERN VENEZUELA

MCMAHON Cathleen Elizabeth
Notre Dame University. Ph.D. 2000
(Texto completo 250 p. en DVD anexo, carpeta 258)

Caribbean tectonic evolution has been a focus of study for over three decades. Most research of the Caribbean regional development has focused on interpreting geophysical and structural geology. As such models for Caribbean region account for only the geophysical data observed. The Caribbean and South American plates have been in oblique collision for the past 40 Ma. The plate boundary zone presently extends from western Colombia to Trinidad, off the coast of eastern Venezuela. The boundary zone is composed of several imbricated thrust fault blocks; many lithological units are repeated in several of the blocks across the boundary zone.

Five igneous and meta-igneous bodies pre-dating and post-dating the onset of oblique collision were sampled, and their geochemical compositions were determined. Three of the five sites sampled which formed prior to 40 Ma: the Paraguana Peninsula meta-igneous suite (Santa Ana, Tausabana-Rodeo, and Arajó outcrops), the Tinaquillo peridotite complex peridotite and gabbroic granulites, and the El Copey metamorphosed pillow lavas, show geochemical similarities (trace and major element and Sr and Nd isotopeic compositions) and ages which designate them as portions of the Caribbean Large Igneous Province (CLIP), formed at the Galapagos hotspot and obducted to South America during oblique collision.

Two igneous suites post-dating the onset of oblique collision were sampled: the Falcón intrusives of northwestern Venezuela and the Carúpano rhyolites of northeastern Venezuela. The Falcón mafic igneous plugs and sills intruded the Falcón basin between 23 and 15 Ma; their geochemistries define a source that initially contained 80% depleted mantle and 20% enriched mantle and progressed to a source composed of 30% enriched mantle and 70% depleted mantle, reflecting melting at the asthenospheric (depleted) and lithospheric (enriched) mantle interface. Geochemical simitarities between the 5 Ma Carúpano rhyolites and extrusive rocks on the southern Lesser Antilles island of Grenada, and their striking geochemical similarities to continental crust, suggest the rhyolites are a continental expression of Lesser Antilles volcanism. These models support the hypothesis of RUSSO & SPEED (1194).

PETROGENESIS OF THE ECLOGITIC ROCKS OF ISLA DE MARGARITA, VENEZUELA

NAVARRO FARRÁN Enrique
University of Kentucky. Ph.D. 1974.
(Texto completo 240 p. en DVD anexo, carpeta 259)

Eclogitic rocks exposed in the Island of Margarita (Eastern Venezuela) can be divided into two main types: the first type, includes those found as isolated blocks and boudins within the schists and quartzites of the Juan Griego Group. These are interpreted as being allocthonous. The second type (Pedro González type) includes those rocks that occur as tabular masses conformable to schists and gneisses of the Greenstone Division (Juan Griego Group). They are restricted to the northeastern part of the Island of Margarita.

Several lithological types have been observed in these eclogites, from true eclogites to amphibolites. They have been derived from early-orogenic basalts lava flows of spilitic affinity which suffered metamorphism under a high P/T regime yielding ophiolitic eclogites. A later increase in temperature affected the same rocks producing common eclogites.

Determinations of P-wave velocities gave values of 7.0 km/sec for true eclogites and 3.6 km/sec for amphibolites, indicating in all cases the crustal origin of these rocks, since higher values would be expected for mantle derived eclogites.

The mineralogy of the eclogites can be expressed in terms of their four principal mineral constituents: garnet, clinopyroxene, amphibole and white mica. Garnet is essentially almandine, with moderate grossularite content and low spessartite and pyrope contents. Clinopyroxene is omphacite, with very high acmite component. Amphibole is of the sub-calcic type between barroisite and Ca-glaucophane. The white mica is essentially paragonite with minor K in solid solution.

The metamorphic history of these rocks can be summarized in two major events. A first event, typical of the blueschist facies (8-9Kb, 200-300ºC), changed the original basaltic assemblage of the volcanic rocks into an ophiolitic eclogite assemblage (lawsonite + jadeitic pyroxene + Fe-rich garnet). The second event, characterized by higher temperatures of metamorphism (amphibolite facies, 8-9Kb and 600ºC) changed the previous assemblage into omphacite + Fe-Mg garnet + paragonite, typical of common eclogites. Later transformations of the eclogites under high P H_2O conditions gave a suite of amphibole eclogites, garnet amphibolites and amphibolites.

Investigations of the extent of the chemical equilibrations domains for Mg, Fe, Ca, and Mn in these rocks indicate that for different elements the domain sizes and shapes are different. Extensive equilibration domains were observed for the above mentioned elements, probably due to original chemical homogeneity of the proto-rock rather than equilibration produced during metamorphism.

Very complex zonation patterns were observed studying the distribution of Mg, Fe, Ca and Mn in the garnets of several types of eclogitic rocks (true eclogites, amphibole eclogites and garnet amphibolites). In general, normal zonation profiles were observed for Mg and Mn, while Fe and Ca profiles proved to be oscillatory in many of the cases. At least two stages can be correlated with the two metamorphic events that affected the eclogitic rocks. Petrographic evidence of the later transformations in the garnets has also been observed.

An island arc-continent collision, mountain belt model seems to be the best explanation of the present geological situation observed in the Venezuelan northern coast range of which the Island of Margarita is a part. This model also gives a satisfactory explanation of the two postulated metamorphic events that affected the eclogitic rocks.

PALEOMAGNETIS OF THE GUAYANA SHIELD, VENEZUELA AND ITS IMPLICATIONS CONCERNING PROTEROZOIC TECTONICS OF SOUTH AMERICA AND AFRICA

ONSTOTT Tullis Cullen
Princeton University. Ph.D. 1981
(Texto completo 432 p. en DVD anexo, carpeta 260)

300 samples (47 sites) were collected from five major igneous and metamorphic stratigraphic units (2.1 to 1.5 b.y.) of the Venezuelan Guayana Shield for paleomagnetic analyses. The purpose was to gather paleomagnetic evidence to determine whether the Guayana Shield was contiguous to the African shields during Proterozoic.

All samples were stepwise demagnetized in alternating fields up to 50 mT and pilot samples were thermally demagnetized. The data were analyzed using minimum dispersion, and vector analysis of zijderveld vector diagrams. Both Fisherian and Bingham statistics (ONSTOTT, 1979) were used to evaluate the data from each site and from each stratigraphic unit.

The results of these analyses are the following:

1) Two or more components of magnetization were frequently isolated by alternating field or thermal demagnetization.

2) The more stable components present in the Imataca Complex and the Supamo-Pastora province, were probably acquired during post-orogenic uplift at 2.1 to 1.9 b.y.

3) The more stable components present in the intrusive units, the Roraima intrusive suite and the Parguaza rapakivi batholith, are most likely primary thermal remanent magnetizations acquired at 1660 and 1550 m.y. respectively.

4) Origin of the magnetization in the Cuchivero and Roraima groups is less certain, but they were probably acquired between 1.9 and 1.6 b.y.

5) Despite the broad time span involved, the corresponding site-poles are closely grouped.

6) The less stable secondary directions observed in the metamorphic and intrusive units probably represent partial remagnetization during the low-grade Nickorie metamorphic episode date at 1.2 b.y.

The following conclusions are drawn from comparison of this newly obtained data with the published Precambrian paleomagnetic record for Africa and South America:

1) Agreement with the African Precambrian paleomagnetic data is better when South America is restored to its pre-drift position.

2) The more stable component site-poles straddle the equator east of Africa (30ºN to 30ºS and 40ºE to 80ºE) still remain significantly different from the African polar wander path, particularly the well-established 2060 m.y. to 1880 m.y. segment. This discrepancy can be resolved by rotating the Kalahari Shield approximately 60º clockwise about a local pole of rotation. Such a rotation corresponds to large-scale (thousands of kilometers) transcurrent motions along the upper Proterozoic mobile belts bounding the Kalahari Shield.

3) Detailed comparison of the paleomagnetic data from the Guayana Shield and the West African Craton suggests that displacements of similar magnitude have occurred along the upper Proterozoic Brasilia mobile belt.

4) The rotated secondary site-poles fall close to the African polar wander path for 1.2 to 1.0 b.y. This latter correlation suggest that little large-scale horizontal plate motions have occurred between the Guayana and West African shields since this time and that the Rokelides Pan African belt is not a suture zone.

The results of this study suggest that transcurrent motion were the predominant tectonic style in the Proterozoic, distinct from the sea floor spreading and subduction of the Phanerozoic.

LOS SISTEMAS DE INFORMACIÓN GEOGRÁFICA Y LA TELEDETECCIÓN ESPACIAL EN EL ANÁLISIS DE LA INFORMACIÓN GEOLÓGICA DE LA REGIÓN TODASANA-CABO CODERA-CAPAYA, CORDILLERA DE LA COSTA

PEREZ F. Luis A.
UCV. M.sc. 2005

(Texto completo 110 p. en DVD anexo, carpeta 261)

Con el objetivo de contribuir al conocimiento geológico de la Cordillera de la Costa, se han aplicado algunos algoritmos automatizados y semiautomatizados basados en técnicas desarrolladas en Sistemas de Información Geográfica (SIG) y Procesamiento Digital de Imágenes (PDI), que permitieron implementar análisis morfométricos, espectrales y geobotánicos y su relación con las unidades geológicas que componen la Cordillera de la Costa en su sección central, en un área que tiene una superficie aproximada de 1.591 km^2.

En relación a las unidades geológicas, estas se presentan de forma diversa debido a que el área de estudio esta incluida en parte de un cinturón de deformación del sureste del Caribe y norte de Sudamérica localizado en el centronorte de Venezuela. Producto de esto, la Cordillera de la Costa es litológica, petrológica y geocronologicamente muy heterogénea formada por terrenos de afinidad oceánica, de margen continental y de basamento continental.

Por estas razones, esta región está compuesta fundamentalmente de rocas ígneo- metamórficas de edades que van desde el Precámbrico hasta el Cretácico y marginalmente diversas unidades sedimentarias del Terciario al Reciente. Esto es evidenciado por la cartografía de geología de superficie en el área de estudio que muestra la existencia de al menos 26 unidades geológicas distintas, siendo 18 igneo-metamórficas agrupadas por las napas de la Serranía del Litoral (Superasociación La Costa: Complejo Nirgua (CN), Anfibolita de Cabo Codera (Ccc), Metadiorita de Todasana (Cto) y algunos cuerpos de Serpentinitas (Sp); Asociación Metamórfica Caracas: Esquisto de Chuspita (CaC), Esquisto de las Mecedes (CaM), Esquisto de las Brisas (CaB) y Mármol de Zenda (CaBz); y la Superasociación Avila representada por las siguientes unidades geológicas: Metatonalita de Caruao (Ac), Complejo San Julián (Asj y Asjf) y el Augengneis de Peña de Mora (APM)) y por las napas de la Serranía del Interior (Filita de Urape (Tu, Tug); y Filita de Murugurata (TM) (URBANI & RODRÍGUEZ 2004). Como se comentó anteriormente, estas unidades geológicas se correlacionaron con algunos análisis morfométricos y visuales del terreno, estos versaron en la implementación de los siguientes algoritmos: modelos digitales de elevación (MDE). A partir de este, se realizó el modelo de iluminación y sombras (MDIS) con azimuth de iluminación (45°, 90°, 135°, 180°, 215°, 270°, 315°) que sirvió para corregir las interpretaciones geológicas elaboradas anteriormente y permitió una primera mejora cartográfica tanto de las unidades geológicas en el área de estudio como las lineaciones, al incorporar nuevas interpretaciones.

Esta diferenciación mejoró basamento al incorporar un análisis de textura (utilizando la dimensión fractal), presentando un coeficiente de correlación de 0,8 con respecto a las unidades geológicas. Siendo la dimensión fractal > 2,2 para las unidades ígneo-metamórficas y < 2,2 para unidades sedimentarias, explicado por las propiedades de los minerales asociados a la matriz de la roca y su resistencia tanto a la erosión como a la meteorización. Asimismo, se incorporaron otro tipo de indicadores como el nivel de disección y pendientes, los cuales mostraron coeficientes de correlación de 0,89 y 0,81 respectivamente. Por otro lado, se trabajó con la cobertura vegetal para poder hacer la relación con respecto a la geología de superficie. Las rocas ígneas y metamórficas presentaron una alta correlación espacial con bosques y las sedimentarias con herbazales y matorrales. Adicionado a esto, se procesaron dos tipos de imágenes de percepción remota, entre los cuales están las imágenes Landsat 7 ETM+ path/row 003/053 y 004/054 y una imagen Radarsat; las cuales contribuyeron a disminuir la incertidumbre en algunas áreas poco muestreadas de acuerdo con la data existente, a partir de la aplicación de algunos algoritmos de realces de estructuras y extracción de unidades geológicas, entre los cuales están filtros direccionales y clasificaciones supervisadas y nos supervisadas, con coeficientes de correlación en el orden de 0,53 y 0,73.

Esta información permitió la generación de una cartografía geológica mejorada, en la cual se enriquece el conocimiento estructural del área de estudio pasando de 298 km de lineaciones registradas en los mapas geológicos existentes a 713 km, de esta forma se incrementó el registro de las estructuras geológicas en un 58 %, ofreciéndose además un nuevo esquema geológico en relación a límites de unidades geológicas como consecuencia de la aplicación de tecnologías SIG y TE.

STRATIGRAPHY AND STRUCTURE OF THE GOAJIRA PENINSULA, NORTWESTERN VENEZUELA, AND NORTHEASTER COLOMBIA

ROLLINS John Flett
The University of Nebraska. Ph. D. 1960
(Texto completo 319 p. en DVD anexo, carpeta 262)

The Goajira Peninsula is located in the northwestern part of Venezuela and northeastern part of Colombia. This remote area has remained virtually unknown geologically until very recently. In this work a large portion of the Goajira has been studied and mapped in detail. Emphasis has been placed upon the stratigraphic succession and the structural geology. Several new formations have been defined and the type sections measured.

The basement complex of the Goajira is composed of a variety of igneous and metamorphic rocs. The age of most of the basement complex is considered to be pre-La Quinta (Triassic). There are also La Quinta age rhyolites and related rocks which occur as sill, dikes, and flows. There is no evidence for Cretaceous igneous activity.

A sedimentary sequence, having an aggregate thickness in excess of 9.500 meters rests upon the basement complex. The earliest-known sediments are the La Quinta redbeds and the overlying Cojoro sandstones. These are considered to be late Triassic and possibly early Jurassic in age. More than 850 meters of La Quinta–Cojoro sediments are present.

An east-west trending depositional trough (Cocinas trough) was formed across the central part of the Goajira during the Jurassic. At least 3250 meters of sediments were deposited in the trough during the Jurassic period. The sediments are subdivided into the Cheterlo Formation at the bottom, overlain successively by the Caju, Pachepa and Jipi formations.

A nearly complete Cretaceous record is present on the Peninsula which in principally of marine origin. An aggregate thickness in excess of 3000 meters is present. The following formations from bottom to top are represented: Rio Negro, Yuruma, Cogollo, La Luna, and Colon.

At the close of the Cretaceous, strong orogenic movements folded and uplifted the region exposing the Goajira to active erosion.

During the upper Eocene interval, shallow marine sandstones and limestones were deposited (Macarao Formation), at least in the southeastern corner of the Peninsula.

After a second period of orogeny, a broad, shallow marine basin developed over much of the interior of the Goajira. Over 2.400 meters of Oligocene and younger sediments were deposited. The following formations are present from bottom to top: Uitpa, Sillamana, Guararies, and Castilletes. Coralline reefs are found well developed in the Goajira in sediments of the upper Jurassic, Lower Cretaceous and Oligocene.

Numerous fossils, principally molluscs, were found in the Jurassic, Cretaceous, and Tertiary beds. These have been identified and a resume of the biostratigraphy is included in the dissertation. It can be shown that parts of the sedimentary sequence are intimately related with the equivalent beds in the Maracaibo basin.

The structural geology of the Goajira presents a number of highly complex features. Nearly all the structural development is thought to be due to compressional deformation.

The tectonic framework has been subdivided into five structural elements as follows: the stable platform area; the Cocinas trough; the Serrania Jarara uplift; The Serrania Macuire uplift; and the Tertiary basis structures.

The most prominent feature is the Cocinas trough which contains over 5.000 meters of sediment. Compressional movements, acting nearly perpendicular to the axis of the trough have folded and faulted the rocks. Three dominant fault trends are present: (1) an older, longitudinal set of mostly reverse faults with some strike-slip movements; cut by (2) a major set of northwest-trending strike-slip faults; and (3) a minor set of northeast-trending strike-slip faults.

GEOLOGY OF THE ACARIGUA AREA, VENEZUELA

SKERLEC Grant Michael
Princeton University. Ph.D. 1979
(Texto completo 315 p. en DVD anexo, carpeta 263)

The Acarigua area is part of both the western termination of the Caribbean mountains and of the northern Venezuelan Andes. The metasediments of the Caribbean mountains terminate along a complex zone of low-angle thrust faults and are not structurally continuous with the adjacent, coeval Cretaceous platform sediments as early workers believed.

In the Acarigua area the Caribbean mountains consist of three tectonic belts that are continuations of similar belts found farther to the east. The northern Cordillera de la Costa Belt contains lower greenschist facies metasediments of the Early Cretaceous Caracas Group; a Central Belt consist of Late Cretaceous, lower-grade metasediments that have been named the Villanueva Group; and a southernmost belt consist of Paleocene flysch sediments of the Rio Guache Formation. Both the Caracas Group and the Villanueva Group are part of the former "Villanueva Formation".

The Caracas Group is divided into a lower sequence of limestones, conglomerates and phyllites of the Mamey Formation and conformably overlying sequence of quartz arenites and phyllites that is here named the Buena Vista Formation.

The Villanueva Group is subdivided into four formations that are, from oldest to youngest, the Volcancito, Nuezalito, Yacambu and Palo Gacho Formations. The Central Belt preserves a record of a stage in the evolution of the Caribbean mountains that is rarely present elsewhere. The Paracotos Belt, although it is now largely obscured by thrusting of the Villa de Cura, Tinaco and Cordillera de la Costa Belts, is believed to be a remnant of the Central Belt.

The black, carbonaceous limestones and phyllites of the Volcancito Formation were part of and euxinic basin that was bordered on the north by both the Tinaco and Villa de Cura Belts of the Caribbean Mountains. Conglomerates, graywackes and boulder shales of the Late Cretaceous Nuezalito Formation were deposited along the northern margin of this euxinic basin.

The provenance of the Nuezalito and correlative formations indicates that portions of the Caribbean mountains had already been metamorphosed, intruded by a sequence of zoned ultramafic complexes and associated igneous rocks, intensely deformed and uplifted prior to the Turonian-Coniacian.

Southward thrusting of the Caribbean mountains is believed to have begun during deposition of the Nuezalito Formation and continued through the deposition of both the Campanian-Maastrictian phyllite, chert and limestone of Yacambu and Palo Gacho formations and the Paleocene Rio Guache Formation.

The western Caribbean mountains contain a series of low-angle thrust faults that place the metasediments of the Cordillera de la Costa Belt over the lower grade metasediments of the Central Belt, which is thrust in turn over the Rio Guache Formation. The general structural pattern is a series of thrust faults "stepping up section" to both the south and west.

These low-angle thrust faults of the Caribbean mountains are offset by a complex series of high-angle faults, including the Bocono fault, that were produced by uplift of the Venezuelan Andes during the Cenozoic. Offset of these basal thrust faults suggest that the maximum possible amount of right-lateral strike-slip displacement along the Bocono fault is 50 kilometers.

Isopach data for Cretaceous platform sediment suggest that the western limit of thrust faulting was caused by a thinning of decollement horizons along a pronounced north-south jog in the Venezuelan continental margin. A similar termination of the Ruma metamorphic belt, north of the Acarigua region, is believed to be of similar origin.

PHASE EQUILIBRIA AND SPATIAL EXTENT OF CHEMICAL EQUILIBRATION OF MIGMATITE ROCKS FROM COLORADO, USA AND VENEZUELA

URBANI P.Franco
University of Kentucky. Ph.D. 1975
(Texto completo 429 p. en DVD anexo, carpeta 264)

Migmatite is a megascopically composite rock consisting of two or more petrographically different parts. One part is the country rock and the other is of pegmatitic, aplitic, granitic, or generally, plutonic appearance. Migmatites are frequently encountered in the contact zones of most igneous complexes. In this work, an attempt was made to understand the chemical variations that take place in different minerals that occur in migmatites. To this end, the spatial extent of chemical equilibration was examined using samples of different types of migmatite structures. The samples came from three different geographic areas: Almont, Colorado, and La Sabana and Guaremal areas in the Venezuelan Coast Range.

As a result of this study it was found that the stictolithic structures show biotites equilibrated over small areas (less than 2x1 cm) and domains extend over different stictos. A sample from lit-par-lit structure shows domains elongated parallel to the lithologic boundaries. The samples from agmatic structures show domains of irregular shape and variable size and these always cross-cut lithologic boundaries. One sample has a metasedimentary paleosome in which the domains are highly elongated and parallel to foliation. Samples from nebulitic structures were also analyzed and the equilibration domains are also irregularly shaped but always cross the fringes of the structure.

A quartz-gabbro sample (DF-90) had biotite and hornblende coexisting. Both minerals were analyzed and found to equilibrate over areas usually as large as a hand specimen with only minor irregularities. The distribution coefficient $K_{Bi/Hb}$ was calculated and plotted in the context of the rock. The areas in which values are constant are large and greater than hand specimen size for most elements. The large size of domains of equilibration in this sample could have been the result of a large scale equilibration during the crystallization of the gabbro.

In the analyzed samples there is no obvious systematic variation in domain size from "low" to "high grade" migmatites. There seems to be, however, an increase in size of the domains of equilibration in sequence of whole-rock composition as follows:

tonalite ==> granodiorite
quartz-diorite ==> quartz-gabbro.

This sequence parallels the variation in color index and An content of plagioclase suggesting a proportionality between domain size and the temperature attained by the original rock.

It was found that the domain size of the migmatite samples with tonalitic neosomes are similar to the size of domains in the high grade metamorphic rocks studied by BLACKBURN (1968). The maximum temperature attained by this assemblage is about 650ºC (DENNEN *et al.*, 1970). On the other hand, PINWINSKII (1968) and LAMBERT & WYLLIE (1974) show that the temperature of crystallization of tonalites is about 700ºC. This suggests that, even if the migmatites are formed at or near anatectic conditions, the temperature seems to be the principal factor in the determination of the size of the domains of chemical equilibration.

The volume of domains were calculated and found to increase from about 1 cm^3 in the stictolithic structure (a very "low grade" migmatite) to about 2 to 7 cm^3 in the migmatites from Colorado and to even larger values (9, 16 and 63 cm^3) in the "medium" to "high grade" migmatites of quartz-diorite and quartz-gabbro composition from Venezuela.

An intergranular distance analysis was carried out for biotite and hornblende crystals in the samples used in equilibration studies. No systematic variations were found that could be due to the differences in migmatite structures with the exception of two nebulitic structures which show a trend toward a large scale clustering. The nucleation sites for biotites and hornblendes seem, for the most part, to have been evenly distributed in space, but randomly spaced nucleation sites are found locally.

THE TECTONICS OF NORTHEASTERN VENEZUELA AND THE SOUTHEASTERN OF CARIBBEAN SEA

VIERBUCHEN Richard Carl Jr.
Princeton University. Ph.D. 1979
(Texto completo 196 p. en DVD anexo, carpeta 265)

In the southeastern Caribbean region the Caribbean-South American plate boundary is a wide zone of active deformation that accommodates convergent and dextral motion. The right-lateral El Pilar Fault system, which deforms Quaternary strata and is seismically active, is a major feature within this zone. This fault extends from the Cariaco trench in the bay of Barcelona to the east coast of Trinidad, forming the boundary between two very different geologic provinces. To the north of the fault lies the eastern Cordillera de la Costa: Lower Cretaceous metasediments and metavolcanics that were deposited, at least in part, on a basement of serpentine, then metamorphosed to the greenschist facies and strongly deformed by compressive stresses. To the south is the Serranía del Interior, a fold and thrust belt composed of Cretaceous and Paleogene sediments that accumulated in a comparatively stable tectonic environment. Detailed field work in northeastern Venezuela has proven that there the El Pilar Fault consists of two major branches, one of which was not recognized in previous studies. Geologic mapping demonstrates a cumulative dextral displacement that must exceed 20 km. Moreover, a total displacement of 150 km or more may be necessary to account for the steep gravity gradient at the fault.

The post-Miocene tectonics of the southeastern Caribbean region can be interpreted as the interaction between the Caribbean and South American plates and two small, non-rigid blocks - the Bonaire Block, defined by SILVER *et al.* (1975) to be the crust between the Oca – San Sebastian Fault, and the Curacao ridge, and the Paria block, which comprises northeastern Venezuela and Trinidad and is bounded by the El Pilar and Urica faults. In particular, the formation of the Cariaco trench can be attributed to relative motion between these four tectonic units over the last 5-10 million years. The magnitudes of relative motion can be estimated from the offset of the El Pilar system within the Cariaco trench. Since the Late Miocene, offset has been less than 100 km on the El Pilar Fault and less than 140 km on the San Sebastian Fault. Movement between Paria and South America has been roughly 50 km and movement

between the Bonaire Block and the Caribbean has amounted to roughly 40 km of dextral motion along the Los Roques Canyon and an equal overthrusting at the eastern end of the Curacao ridge.

Motion between the North American and South American plates has significantly affected circum-Caribbean tectonics. For example, the intersection of the American plate boundary with the Lesser Antilles Island Arc may cause the abrupt change in seismicity along the arc at 15ºN and may have in the past influenced the migration of volcanism in the northern half of the arc. The Barracuda ridge in the western Atlantic is thought to result from the juxtaposition of seafloor of disparate age: younger seafloor formed during a period of extension between the American plates and now lying south of the ridge, with older seafloor to the north of the ridge.

EDAD Y RELACIONES DE CAMPO DEL GRUPO EL BARBASCO, MACIZO DE EL BAÚL

REYES A.

ULA. Fac. Ingeniería. Escuela de Ingeniería Geológica. Mérida. Trabajo de ascenso. 2003

(Texto completo 119 p. en DVD anexo, carpeta 266)

En la reconstrucción de las cuencas sedimentarias paleozoicas, el macizo de El Baúl es pieza clave como punto de enlace entre las cuencas oriental y occidental de Venezuela. Este trabajo plantea como objetivo fundamental definir la geología del macizo de El Baúl con énfasis directo en la estratigrafía del Grupo El Barbasco al igual que las relaciones de campo con el granito de El Baúl y las volcánicas de Guacamayas.

Entre los aspectos más destacados podemos resaltar, la definición de procesos petrológicos desarrollados en el límite diagenesis–metamorfismo, los que conllevan a encontrar rocas con diagenesis profunda (Formación Mireles) y rocas con rasgos metamórficos (formaciones Cerrajón y Cañaote), adicionalmente se constato la presencia de metamorfismo hidrotermal y no metamorfismo de contacto como fue descrito originalmente; se describen por primera vez rocas volcánicas ácidas, interestratificadas con las rocas metasedimentarias y con características petrográficas claramente diferenciables de las volcánicas de Guacamayas, son altamente feldespáticas, y pudieran llegar a representar hasta un 8% de todo el grupo.

En el orden estratigráfico se plantea una nueva columna litoestratigráfica para el Grupo El Barbasco, con edades desde Cámbrico superior a Ordovícico inferior, y un orden de base a tope inverso al previo, esto es Formación Cañaote en la base, Formación Cerrajón parte media y Formación Mireles en el tope. Este orden estratigráfico se sustenta en relaciones de campo, rasgos estructurales y procesos petrológicos, aún así hasta no validarse biocronológicamente este orden, el planteamiento continuara siendo sólo una hipótesis. Al igual que en la literatura previa, se correlaciona el Grupo El Barbasco con las formaciones Hato Viejo y Carrizal.